IN THE CLAIMS

What is claimed is:

1. A semiconductor device on a silicon substrate, having a device structure including an insulating film formed from gas containing carbon, comprising:

a silicon nitride film formed between the insulating film and the silicon substrate for preventing carbon from diffusing to the silicon substrate.

2. The semiconductor device according to claim 1, wherein:

the insulating film includes tantalum oxide (Ta_2O_5).

3. The semiconductor device of claim 2, wherein:

the semiconductor device is a dynamic random access memory having a memory cell capacitor film including the tantalum oxide.

4. The semiconductor device of claim 3, wherein:

the semiconductor device includes a contact which penetrates an interlayer insulating film and is electrically connected with a diffusion layer in the silicon substrate; and

the silicon nitride film is formed on the silicon substrate as a carbon diffusion preventing film while traversing a region except a portion for providing the electrical connection between the contact and the diffusion layer.

5. The semiconductor device of claim 3, wherein:

the semiconductor device includes a contact that penetrates a first interlayer insulating film and is electrically connected with a diffusion layer formed in the silicon substrate and a capacitor contact that is interposed between a lower electrode of the memory cell capacitor and the contact while penetrating a second interlayer insulating film and a third interlayer insulating film; and

the silicon nitride film is formed on the third interlayer insulating film while traversing a region except a connection portion between the lower electrode and the capacitor contact.

6. The semiconductor device of claim 3, wherein:

the semiconductor device includes a contact that is electrically connected with the diffusion layer formed in the silicon substrate while penetrating the first interlayer insulating film;

the contact is electrically connected to a capacitor contact that is interposed between a lower electrode of the memory cell capacitor and the contact while penetrating a second interlayer insulating film and a third interlayer insulating film for providing an electrical connection between the lower electrode and the contact; and

the silicon nitride film is formed between the second and third interlayer insulating films.

7. A method for manufacturing a semiconductor device on a silicon substrate, having a device structure including an insulating film formed from gas containing carbon, comprising the step of:

forming a silicon nitride film between the insulating film and the silicon substrate for preventing carbon from diffusing to the silicon substrate.

8. The method for manufacturing a semiconductor device of claim 7, further including the steps of:

forming a word line on a silicon substrate;

forming the silicon nitride film over the entire surface of the substrate including the word line;

forming a first interlayer insulating film on the silicon nitride film;

etching the first interlayer insulating film to form a cell contact hole with an etching method selective for the silicon nitride film to expose the silicon nitride film at a bottom of the cell contact hole;

selectively etching the silicon nitride film exposed at the bottom of the cell contact hole to expose the silicon substrate; and

forming a cell contact plug in the cell contact hole.

9. The method for manufacturing a semiconductor device of claim 8, further including the steps of:

forming a first capacitor electrode electrically connected to the cell contact plug;

forming the insulating film; and

forming a second capacitor electrode on the insulating film.

10. The method for manufacturing a semiconductor device of claim 9, wherein:

the insulating film includes tantalum oxide (Ta_2O_5).

11. The method for manufacturing a semiconductor device of claim 7, further including the steps of:

forming a word line on a silicon substrate;

forming a first interlayer insulating film on the silicon substrate including the word line;

forming a cell contact plug through the first interlayer insulating film to provide an electrical connection with a diffusion layer in the silicon substrate;

forming a second interlayer insulating film on the first interlayer insulating film;

forming a bit line on the second interlayer insulating film;

forming a third interlayer insulating film on the second interlayer insulating film including the bit line;

forming a capacitor contact plug through the second and third interlayer insulating films to provide an electrical connection to the cell contact plug; and

forming the silicon nitride film on the third interlayer insulating film

and capacitor contact plug.

12. The method for manufacturing a semiconductor device of claim 11, further including the steps of:

forming a fourth interlayer insulating film on the silicon nitride film;

forming a capacitor formation section in the fourth interlayer insulating film to expose the silicon nitride film; and

etching the exposed silicon nitride film to expose the capacitor contact plug.

13. The method for manufacturing a semiconductor device of claim 12, further including the step of:

forming a capacitor including the insulating film in the capacitor formation section.

14. The method for manufacturing a semiconductor device of claim 7, further including the steps of:

forming a word line on a silicon substrate;

forming a first interlayer insulating film on the silicon substrate including the word line;

forming a cell contact plug through the first interlayer insulating film to provide an electrical connection with a diffusion layer in the silicon substrate;

forming a second interlayer insulating film on the first interlayer insulating film;

forming a bit line on the second interlayer insulating film;

forming a third interlayer insulating film on the second interlayer insulating film including the bit line;

forming the silicon nitride film on the third interlayer insulating film; and

forming a capacitor contact plug through the second and third interlayer insulating films and the silicon nitride film to provide an electrical connection to the cell contact plug.

15. The method for manufacturing a semiconductor device of claim 14, further including the step of:

forming a capacitor including the insulating film and having a capacitor electrode electrically connected to the capacitor contact plug.

16. The method for manufacturing a semiconductor device of claim 7, further including the steps of:

forming a word line on a silicon substrate;

forming a first interlayer insulating film on the silicon substrate including the word line;

forming a cell contact plug through the first interlayer insulating film to provide an electrical connection with a diffusion layer in the silicon

substrate;

forming a second interlayer insulating film on the first interlayer insulating film;

forming a bit line on the second interlayer insulating film;

forming the silicon nitride film on the second interlayer insulating film including the bit line;

forming a third interlayer insulating film on the silicon nitride film;

etching the third interlayer insulating film to form a contact hole and expose the silicon nitride film at a bottom of the contact hole;

etching the silicon nitride film at the bottom of the contact hole to expose the second interlayer insulating film;

etching the exposed second interlayer insulating film at the bottom of the contact hole to provide a capacitor contact hole including the contact hole; and

forming a capacitor contact plug through the second and third interlayer insulating films to provide an electrical connection to the cell contact plug.

17. The method for manufacturing a semiconductor device of claim 16, further including the step of:

forming a capacitor including the insulating film and having a capacitor electrode electrically connected to the capacitor contact plug.

18. A method for manufacturing a semiconductor device on a silicon substrate, having a memory cell including a capacitor insulating film formed from gas containing carbon, comprising the step of:

forming a silicon nitride film between the capacitor insulating film and the silicon substrate for preventing carbon from diffusing to the silicon substrate.

19. The method of manufacturing the semiconductor device of claim 18, wherein:

the capacitor insulating film includes tantalum oxide (Ta_2O_5).

20. The method of manufacturing the semiconductor device of claim 19, wherein:

the capacitor includes an electrode having a hemi-spherical grain structure.